NOVEMBER/DECEMBER 2023

DPH12/GPH12 — CLASSICAL AND STATISTICAL MECHANICS

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. State D–Alembert's Principle.

2. Infer the uses of Poisson bracket.

3. Write down the necessities of Hamilton-Jacobi theory.

4. Define action variables.

5. Interpret the tensor rank of scalar and vector quantity.

6. Why are Euler angles introduced in classical mechanics?

7. What are phase space?

8. Write the postulates of Maxwell-Boltzmann distribution.

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9. List few peculiar properties of liquid helium.

10. Assess the significance of Pauli's theory of paramagnetism.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Appraise the value of H, for the Langrangian of a particle of mass m moving in 1D given as $L = \frac{1}{2} m\dot{x}^2 - bx$, where his a constant.

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Or

(b) Develop the condition for a function to be canonical.

12. (a) Analyze the action angle variables in a system of one degree of freedom.

Or

(b) Compile the concept of forced Harmonic oscillator.

13. (a) Interpret the description of general rotation of a rigid body in terms of Euler angles.

Or

(b) Summarize precession and nutation of the motion of symmetrical top.

14. (a) Compare the properties of micro-canonical, canonical and grand – canonical ensemble.

Or

(b) Derive sackor – Tetrode equation.

15. (a) Estimate the total number of ways in which a gas made up of two particles and be gets arranged in three quantum series using Maxwell-Boltzmann and Fermi Dirac Distribution.

Or

(b) Derive Planck's law of radiation.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Design the equation of motion of simple pendulum using Lagrangian formalism.

17. Construct Hamilton-Jacobi equation from Hamilton's principle function.

18. Evaluate the equation of motion for a symmetrical top in a uniform gravitational field with one point fixed in space.

19. Explain first and second order phase transition.

20. Formulate the energy distribution of bosons by Bose -Einstein statistics.
